

NITROGEN BUFFER GAS EXPERIMENTS
IN MERCURY TRAPPED ION FREQUENCY STANDARDS

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Linear ion trap frequency standard (LITS) technology has been in continuous operation in the NASA Deep Space Network (DSN) since 1997. The need for 10^{-5} mbar of helium buffer gas in an otherwise UHV system creates a tradeoff between vacuum pump life and achievable frequency standard performance. The present DSN standards operate with mechanical pumps (turbo-molecular and associated backing pumps) to provide a relatively constant pumping speed over their operational life. Unattended operation is presently limited to 1-2 years by needed pump maintenance.

Longer operational life is desirable in ground based applications but is mandatory for most spaceflight applications. Recent measurements showing reduced sensitivity to all parameters affecting the second order Doppler shift in a multi-pole linear trap suggest that the highest stability performance can be preserved when using a getterable buffer gas[1]. Measurements using nitrogen as an alternative buffer gas will be reported that could provide long operational lifetimes greater than 10 years using only a small ion pump based vacuum system.

[1] R.L.Tjoelker, J.D. Prestage, L. Maleki, "Improved Timekeeping Using Advanced Trapped Ion Clocks", PTTI, Dana Point, California, December 1999.

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